

IN THE CLAIMS

1. (Currently Amended) A method of forming a solder ball contact, comprising:
  - forming a metal contact pad on a substrate;
  - forming an insulating layer on the metal contact pad;
  - forming a patterned photoresist layer over the insulating layer;
  - using the patterned photoresist layer as a mask to remove ~~removing~~ a portion of the insulating layer to expose a portion of the metal contact pad, thereby forming an exposed portion of the metal contact pad, the exposed portion having a predetermined diameter;
  - depositing solder on the exposed portion of the metal contact pad after the mask is removed such that the depositing solder is performed without using the mask, <sup>insulator as a mask</sup> wherein depositing solder on the exposed portion of the metal contact pad uses a deposition process selected from a group consisting of selective chemical vapor deposition and selective electrolytic deposition, thereby forming a solder contact by selectively depositing solder ~~only~~ on the exposed portion of the metal contact without depositing solder on the insulating layer ~~and~~ without removing a remaining portion of the insulating layer; and
  - annealing the solder contact to form a solder ball contact having a diameter in a range of about 2.5 microns to no greater than 100 microns.
2. (Previously Canceled)
3. (Previously Amended) The method of claim 1, wherein depositing solder further comprises depositing at least one material selected from a group consisting of lead, tin and bismuth.
4. (Original) The method of claim 1, wherein forming a metal contact pad further comprises:
  - forming a layer of zirconium on the substrate;
  - forming a layer of nickel on the layer of zirconium;

forming a layer of copper on the layer of nickel;  
forming a layer of gold on the layer of copper; and  
forming a layer of lead on the layer of gold.

5. (Original) The method of claim 1, wherein forming a metal contact pad further comprises:

forming a layer of zirconium on the substrate, wherein the layer of zirconium is approximately 500 Angstroms thick;

forming a layer of nickel on the layer of zirconium, wherein the layer of nickel is approximately 750 Angstroms thick;

forming a layer of copper on the layer of nickel, wherein the layer of copper is approximately 5000 Angstroms thick;

forming a layer of gold on the layer of copper, wherein the layer of gold is approximately 750 Angstroms thick; and

forming a layer of lead on the layer of gold, wherein the layer of lead is approximately 500 Angstroms thick.

6. (Original) The method of claim 1, wherein annealing the solder contact to form a solder ball contact comprises a solder ball contact approximating a spherical shape.

7. (Original) The method of claim 1, wherein annealing the solder contact to form a solder ball contact comprises a solder ball contact having a spherical portion and a flat contact portion.

8. (Original) The method of claim 1, wherein removing a portion of the insulating layer further comprises forming an exposed portion of the metal contact pad having a diameter of approximately 2 microns.

9. (Currently Amended) A method of forming a solder ball contact, comprising:  
forming a metal contact pad on a substrate;  
forming an insulating layer on the metal contact pad;

forming a patterned photoresist layer over the insulating layer;

using the patterned photoresist layer as a mask to remove ~~removing~~ a portion of the insulating layer to expose a portion of the metal contact pad, thereby forming an exposed portion of the metal contact pad;

removing the patterned photoresist layer;

depositing solder on the exposed portion of the metal contact pad after the patterned photoresist layer is removed such that the depositing solder is performed without using the patterned photoresist layer as the mask, thereby forming a solder contact by selectively depositing solder only on the exposed portion of the metal contact and not depositing solder on the insulating layer

maintaining remaining portions of the insulating layer surrounding the solder; and

annealing the solder contact to form a solder ball contact having a diameter in a range of about 2.5 microns to no greater than 100 microns.

10. (Previously Amended) The method of claim 9, wherein depositing solder comprises depositing at least one material selected from a group consisting of lead, tin and bismuth.

11. (Currently Amended) A method of forming a solder ball contact, comprising:

forming a metal contact pad on a substrate;

forming an insulating layer on the metal contact pad;

forming a patterned photoresist layer over the insulating layer;

using the patterned photoresist layer as a mask to remove ~~removing~~ a portion of the insulating layer to expose a portion of the metal contact pad, thereby forming an exposed portion of the metal contact pad, wherein the exposed portion of the metal contact pad has a diameter of approximately 2 microns;

removing the patterned photoresist layer;

selectively depositing lead on the exposed portion of the metal contact pad after the patterned photoresist layer is removed such that the selectively depositing lead is performed without using the patterned photoresist layer as the mask, thereby forming a solder contact in

which solder is selectively deposited [only on the exposed portion of the metal contact and not on the insulating layer]; and

annealing the solder contact to form a solder ball contact without removing remaining portions of the insulating layer .

12. (Currently Amended) A method of forming a solder ball contact, comprising:
  - forming a metal contact pad on a substrate;
  - forming an insulating layer on the metal contact pad;
  - forming a patterned photoresist layer over the insulating layer;
  - using the patterned photoresist layer as a mask to remove ~~removing~~ a portion of the insulating layer to expose a portion of the metal contact pad, thereby forming an exposed portion of the metal contact pad, the exposed portion having a predetermined diameter;
  - removing the patterned photoresist layer;
  - adsorbing reactants on the exposed portion of the metal contact pad;
  - reacting the reactants on the exposed portion of the metal contact pad, thereby forming a solder contact only on the exposed portion of the metal contact pad and not on the insulating layer, wherein the solder contact is formed after the patterned photoresist layer is removed such that the solder contact is formed without using the patterned photoresist layer as the mask;
  - annealing the solder contact to form a solder ball contact having a diameter in a range of about 2.5 microns to no greater than 100 microns ; and
  - leaving remaining portions of the insulating layer as a passivation layer.

13. - 23. (Previously Canceled)

24. - 63. (Previously Withdrawn)

64. (Previously Added) The method of claim 8 wherein annealing the solder contact further comprises annealing the solder contact to form a solder ball contact having a diameter of approximately 2.5 microns.

65. (Previously Added) The method of claim 11 wherein annealing the solder contact further comprises annealing the solder contact to form a solder ball contact having a diameter of approximately 2.5 microns.

66. - 67. (Previously Canceled)

68. (Previously Added) The method of claim 1 performed in the order recited.

69. - 70. (Previously Canceled)

71. (Currently Amended) A method of forming a solder ball contact, consisting essentially of:

forming a metal contact pad on a substrate;

forming an insulating layer on the metal contact pad;

forming a patterned photoresist layer over the insulating layer;

using the patterned photoresist layer as a mask to remove ~~removing~~ a portion of the insulating layer to expose a portion of the metal contact pad, thereby forming an exposed portion of the metal contact pad, the exposed portion having a predetermined diameter;

depositing solder on the exposed portion of the metal contact pad to form a solder contact using selective deposition after the patterned photoresist layer is removed such that the ~~depositing solder is performed without using the patterned photoresist layer as the mask, thereby forming a solder contact;~~ and

annealing the solder contact to form a solder ball contact having a diameter in a range of about 2.5 microns to no greater than 100 microns.

72. - 75. (Previously Canceled)

76. (New) A method comprising:

forming a metal layer on a substrate;

forming a first insulating layer over the metal layer;

forming a first patterned photoresist layer over the metal layer;  
removing the first patterned photoresist layer;  
removing a portion of the first insulating layer to form an exposed portion of the metal layer;  
forming a metal contact over the first insulating layer and connecting to the exposed portion of the metal layer;  
forming a second insulating layer over the metal contact;  
forming a second patterned photoresist layer over the second insulating layer;  
using the second patterned photoresist layer as a mask, removing a portion of the second insulating layer to form an exposed portion of the metal contact;  
removing the second patterned photoresist layer;  
depositing solder on the exposed portion of the metal contact after the second patterned photoresist layer is removed *with the insulator layer as a mask* to form a solder contact; and  
annealing the solder contact to form a solder ball contact.

77. (New) The method of claim 76, wherein forming a metal contact includes forming a metal stack of zirconium, nickel, copper, gold, and lead.

78. (New) The method of claim 76, wherein forming a metal contact includes forming the metal contact having a diameter of approximately 2 microns.

79. (New) The method of claim 76, wherein depositing solder is performed by selective chemical vapor deposition.

80. (New) The method of claim 76, wherein depositing solder is performed by selective electrolytic deposition.

81. (New) The method of claim 76, wherein depositing solder includes depositing at least one material selected from a group consisting of lead, tin and bismuth.

82. (New) The method of claim 76, wherein annealing the solder contact includes annealing the solder contact to form a solder ball contact having a diameter in a range of about 2.5 microns to no greater than 100 microns.

83. (New) A method comprising:

forming a metal layer on a substrate;

forming a first insulating layer over the metal layer;

removing a portion of the first insulating layer to form an exposed portion of the metal layer;

forming a metal contact over the first insulating layer and connecting to the exposed portion of the metal layer;

forming a second insulating layer over the metal contact;

removing a portion of the second insulating layer to form an exposed portion of the metal contact;

depositing solder on the exposed portion of the metal contact to form a solder contact;  
and

annealing the solder contact to form a solder ball contact.

*using second insulator layer as mask  
using the second insulator as a mask*

84. (New) The method of claim 83 further comprising:

forming a first patterned photoresist layer over the first insulating layer to remove the portion of first insulating layer to form the exposed portion of the metal layer.

85. (New) The method of claim 84 further comprising:

forming a second patterned photoresist layer over the second insulating layer to remove the portion of second insulating layer to form the exposed portion of the metal contact.

86. (New) The method of claim 85, wherein depositing solder on the exposed portion of the metal contact is performed after the second photoresist layer is removed such that the depositing solder on the exposed portion of the metal contact includes no photoresist layer used as a mask when the solder is deposited.

87. (New) The method of claim 83, wherein forming a metal contact includes forming a metal stack of zirconium, nickel, copper, gold, and lead.

88. (New) The method of claim 83, wherein forming a metal contact includes forming the metal contact having a diameter of approximately 2 microns.

89. (New) The method of claim 83, wherein depositing solder is performed by selective chemical vapor deposition.

90. (New) The method of claim 83, wherein depositing solder is performed by selective electrolytic deposition.

91. (New) The method of claim 83, wherein annealing the solder contact includes annealing the solder contact to form a solder ball contact having a diameter in a range of about 2.5 microns to no greater than 100 microns